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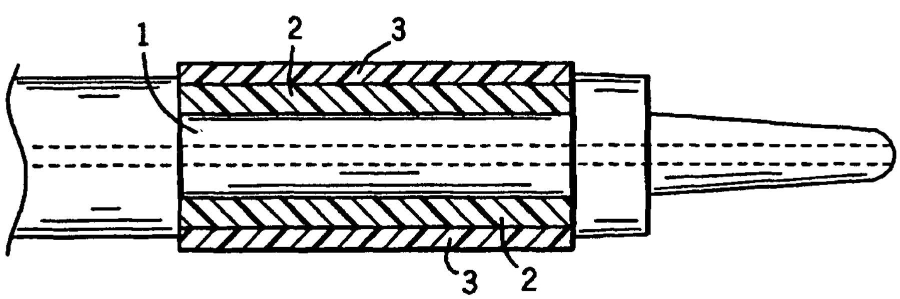
(54) Title: DEFORMABLE GRIP



(57) Abstract: Deformable grips and multilayer materials which can be used to form the grips are disclosed. The grips include a low durometer, thermoplastic elastomer layer (2) and a flexible, higher durometer outer layer (3) which is resistant to oil absorption. Examples of suitable implements which employ the grips include writing implements such as pens, markers and pencils. Methods of producing the multilayer grip materials and the deformable grips are also disclosed.

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DEFORMABLE GRIP

The present application provides manual implements which have a grip including a low durometer thermoplastic elastomer layer and an outer layer of a higher durometer material which is resistant to oil absorption. Typically, the grip is capable of deforming in response to pressure exerted by the hand(s) of a user and returning relatively quickly to its original configuration when the pressure is released. The inclusion of a low durometer thermoplastic elastomer ("low durometer TPE") in the grip tends to give the grip a comfortable "spongyness." In other words, the grip is capable of deforming in response to pressure exerted by the hand(s) of the user of the implement. The degree of spongyness can be controlled by the appropriate choice of shape and thickness of the low durometer layer as well as by the selection of the particular durometer of the material used to form this layer. All references to durometer herein are as determined by ASTM method D-2240 and, unless otherwise expressly noted, are durometers measured using the Shore A scale.

If the grip were to be formed solely from low durometer TPE, the surface of the grip can tend to be sticky and tacky. In addition, low durometer TPEs are often prone to absorbing oils from a user's hands, which can lead to swelling and/or deformation of the shape of the grip. The absorption of oil can also lead to degradation of the TPE layer.

To overcome this problem, the present grips include an outer layer formed from a somewhat harder, higher durometer material, such as a higher durometer thermoplastic material. The outer layer is formed from a material that does not have a sticky and/or tacky feel. Preferably, the higher durometer outer layers are substantially impervious to oils secreted from human skin and related oils, such as sebum oil. The relative resistance of a thermoplastic material to oil absorption can be assessed using methods such as ASTM D471-98e1 and related procedures. For example, in order to examine the potential usefulness of thermoplastic materials in forming the outer layer of the present grip materials, this ASTM method can be carried out substituting sebum oil for the standard oil specified in ASTM D471-98e1.

The outer layer typically has a durometer of at least about 20 Shore A and thermoplastic materials with durometers in the range of about 20 to 100 Shore A are quite suitable. The outer layer can also be formed from materials with even higher durometer.

In such cases, the outer layer is typically quite thin, e.g., 1 to 10 mils thick, in order to achieve the flexibility that is generally desirable for the outer layer of the grip surface. Thermoplastic materials with sufficient oil resistance to form the present grips can generally be chosen by selecting materials which have a durometer of at least about 20 Shore A. More commonly, the outer layer of the grip is formed from a thermoplastic elastomer having a durometer of at least about 35 Shore A and, more desirably about 50 to 70 Shore A. Examples of suitable thermoplastic elastomers which can be produced with the desired flexibility, oil-resistance and tactile feel to be employed as the outer grip layer include elastomeric chlorosulfonated polyethylenes ("CSMs"), thermoplastic polyurethanes ("TPUs"), thermoplastic polyolefins ("TPOs"), nitrile rubbers (e.g., nitrile-butadiene rubbers - "NBRs"), elastomeric alloys ("EAs"), polychloroprene rubbers ("CRs"; also refered to as "neoprenes"), styrenic thermoplastic elastomers, polypropylene, elastomeric copolyesters and the like. Specific examples of suitable materials for forming the outer layer include elastomeric thermoplastic rubbers having the desired oil-resistance sold under the trademark Santoprene® by Advanced Elastomeric Systems. Santoprene® thermoplastic elastomers are commercially available in a range of durometers from 35 to 92 Shore A. Other examples of suitable materials for forming the outer layer include oil resistant thermoplastic elastomers sold under the tradenames Monprene™ (QST, St. Albans, VT) and Thermoplast K™ (Kraiburg, Duluth, GA). Thermoplastic vulcanizates PP/EPDM elastomers with good oil resistance are commercially available under the J-Prene™ tradename from J.Von (Leominster, MA). Oil resistant thermoplastic PVC/NBR elastomers with durometers from 54 to 82 Shore A are commercially available under the Elastamax™ tradename from M.A. Hanna Company (Norcross, GA).

The outer layer should be flexible enough to allow the grip to deform easily in response to pressure from a user's hand. In addition, the higher durometer material will typically impart a dry, soft feel to the grip. Specific examples of suitable higher durometer outer layers include thin (e.g., 5 to 20 mils thick) polypropylene layers and layers formed from other thermoplastic materials having appropriate hardness (as measured by Shore A durometer), flexibility and resistance to oil absorption (e.g., thermoplastic copolyesters).

The outer layer need only be thick enough to impart resistance to oil absorption to the grip. The exact thickness will depend to some extent on the particular choice of higher durometer material, but outer layers with a thickness from about 0.01 mm to about 1-2 mm

may be employed. Suitable embodiments of the present grip, such as those shown in the Figures, typically have an outer higher durometer layer which is about 0.1 to 1.0 mm thick. Depending on the choice of the material used to form the low durometer layer, it may be possible to chemically modify the outer portion of this layer and convert it into a higher durometer, oil resistant layer. In other words, this would result in the formation of a higher durometer, oil resistant skin integrally formed on the outer surface of the low durometer layer.

The low durometer thermoplastic elastomer generally has a durometer of no more than about 20 Shore A, desirably no more than about 10 Shore A and more desirably no more than about 5 Shore A. Examples of suitable low durometer thermoplastic elastomers which can be used to formed the low durometer layer include ethylene/propylene/diene terpolymers ("EPDMs"); elastomeric alloys ("EAs"), such as polyolefin alloys; and thermoplastic polyurethanes ("TPUs"). Styrenic thermoplastic elastomers are another class of TPEs which are particularly well suited for use in forming the low durometer layer. For example, styrene block copolymers ("SBCs"), such as styrene-polyolefin block copolymers, are suitable thermoplastic elastomers for the low durometer layer. As used herein the term "styrene-polyolefin block copolymers" refers to block copolymers having polyolefin block(s) formed from monounsaturated hydrocarbon monomer(s), polyunsaturated hydrocarbon monomer(s) (e.g., dienes such as butediene and isoprene) or combinations thereof. Suitable examples of thermoplastic elastomers formed from styrene-polyolefin block copolymers include styrene-ethylene/butylene-styrene elastomers ("SEBS") and styrene-butadiene-styrene elastomers ("SBS"). Ultrasoft styrenic block copolymers sold under the tradename J-Soft™ (J.Von, Leominster, MA) are examples of thermoplastic elastomers materials which can be used to form the inner layer. Other examples of materials that can be used to form the low durometer layer include very low durometer thermoplastic elastomers sold under the tradenames Monprene™ (QST, St. Albans, VT), J-Prene™ (J.Von, Leominster, MA), and Dynaflex® G (GLS Corp.). Examples of suitable low durometer TPUs include thermoplastic elastomers sold under the trademark Isogel™ by Pittsburgh Plastics (Butler, PA). Suitable SEBS elastomers with durometers less than 10 Shore A are commercially available under the Elastamax™ tradename from M.A. Hanna Company (Norcross, GA).

Super-low, durometer thermoplastic elastomers are particularly suitable for use in the present grips. Such super-low, durometer TPEs generally have a gel-like consistency.

Examples of suitable super-low, durometer thermoplastic elastomers include TPEs with a durometer of about 25 to 50 Shore 00. Super-low, durometer thermoplastic elastomers are available commercially. Examples include thermoplastic elastomers sold under the tradenames Poly-Gel™ (Poly-Gel LLC, Whippany, NJ) and Monprene™ (QST, Inc., St. Albans, VT). Thermoplastic polyurethanes ("TPUs") with very low durometers on the Shore 00 scale are available commercially under the Isogel™ tradename from Pittsburgh Plastics (Butler, PA).

The resiliency necessary to impart a desirable feel to the grip can generally be obtained by employing a low durometer layer which is at least about 1 mm thick. While low durometer layers with thicknesses of 2-4 mm are typically sufficient to impart the desired degree of resiliency to a grip, thicker low durometer layers may be employed, e.g., layers with thicknesses up to about 5-7 mm, where the grip is formed on sports equipment or a hand tool.

The present grip is particularly suitable for use on writing implements, such as pens, markers and pencils. The grip may also be advantageously used on a variety of other types of manual implements, such as personal care items (e.g., razors and toothbrushes), sports equipment (e.g., rackets, bats and the like), hand tools, paintbrushes and other brushes.

The grip material may be employed in a number of different configurations (see, e.g., representative examples described with respect to the Figures shown herein). For example, the grip material may be formed into a tape or sleeve (i.e., in tubular form) for application onto the handle of a manual implement. In such instances, the grip may be formed as a "sandwich" which includes two outer higher durometer layers and an intermediate spongy low durometer.

The grip material employed in the present implements may be produced via conventional polymer processing techniques, such as coextrusion or molding. For example, molded sleeves may be produced for subsequent application onto the body of an implement, e.g., for placement around the barrel of a writing implement. Strips of the present multilayer grip material can be produced by coextrusion of 2 or 3 layers of thermoplastic elastomers using conventional extrusion technology. In one embodiment, a low durometer, thermoplastic elastomer layer and a second layer of an oil-resistant, flexible thermoplastic elastomer are coextruded to form a two layer sandwich material. In another embodiment, the low durometer, thermoplastic elastomer layer is coextruded

between two layers of higher durometer thermoplastic material to form a three layer sandwich construction. In constructions of this type, at least one of the higher durometer thermoplastic layers is resistant to oil absorption.

In another embodiment, the grip may be formed directly on the grip surface of a manual implement using molding techniques. For example, this may be done by sequentially molding layers of thermoplastic materials of the appropriate durometer onto the grip surface of an implement. When this approach is employed, it may only be necessary to initially mold an inner layer formed of low durometer, thermoplastic elastomer on the grip surface followed by molding an outer layer of a flexible thermoplastic material which is resistant to oil absorption on top of the inner low durometer layer.

The accompanying drawings illustrate a number of suitable embodiments of the invention. One skilled in the art will understand, however, that many variations and modifications may be made while remaining within the spirit and scope of the invention.

Figure 1 shows a cross-section of a portion of the barrel of a writing implement. The grip surface of the implement body 1 is covered with an inner layer of low durometer TPE 2. An outer layer of higher durometer material 3 covers the low durometer TPE layer 2 and forms the grip surface which a user's fingers come into contact with. Grips of this type may be produced by sequentially molding ("two-shot molding") the inner low durometer and outer layer onto the body of the implement in grip area.

In another embodiment, the grip can be produced by initially forming a cylindrical sleeve of the higher durometer material. The sleeve is then positioned over the grip body in such a manner so as to form a cavity in the space where the low durometer TPE is desired. The low durometer, thermoplastic elastomer is injected in molten form into the cavity and then allowed to cool to a temperature which will effectively cause the low durometer TPE to "set", typically to a temperature of no more than about 40°C (i.e., close to room temperature).

Figure 2 shows a cross-section of another embodiment of a writing implement of the present invention. The higher durometer layer 3 encases the low durometer TPE layer 2 which is molded on the surface of an indentation in the writing implement body 1. In this embodiment, the higher durometer layer 3 butts up against the ends 5 of the indentation in the implement body 1.

Figures 3 and 4 show cross sectional views of a cylindrical sleeve **10** formed from a three layer sandwich of grip material which can be slid over the barrel of a manual implement to form a grip. The sleeve **10** includes inner **13** and outer layers **11** of higher durometer material and an intermediate layer **12** of low durometer TPE. Sleeves of this type may be produced by a co-extrusion process using an extrusion device with a variety of cross-sectional shapes. For example, since the sleeve which is produced is relatively flexible, it may initially be extruded with a triangular, square or other cross-sectional shape and subsequently relax to a cylindrical shape (i.e., a circular cross-section). The outer layer **11** is generally formed from a thermoplastic elastomer which is resistant to oils and, in particular, resistant to sebum oil.

The present grips may also be constructed in a manner such that an entrapped layer of air (or other gas) forms an additional cushioning layer. Two illustrative embodiments of this version of the present invention are shown in Figures 5 and 6. As shown in Figure 5, the layers of material forming the grip may be molded directly on the barrel of a writing implement body **21** such that an air layer **24** is entrapped between the low durometer TPE layer **22** and the implement body **21**. In the embodiment of the invention shown in Figure 6, the grip is molded such that an air layer **33** is entrapped between the low durometer TPE layer **32** molded directly on the implement body **31** and the outer higher durometer layer **34** which forms the surface of the grip which comes into contact with the fingers of a user.

One suitable embodiment of the invention includes a grip formed from a sandwich construction of an inner very low durometer thermoplastic elastomer sandwiched between two outer layers of a higher durometer material which is resistant to oil absorption. For example, the inner layer can be formed from a super-low, durometer TPE having a gel-like consistency and the outer layers are typically very thin layers of a harder, higher durometer material, such as polypropylene ("PP"). This may be directly molded onto the grip surface of a manual implement or may be formed into a sleeve of grip material such as shown in Figures 3 and 4.

While the making and using of various embodiments of the present invention are discussed herein, it should be appreciated that the present invention provides many applicable inventive concepts which can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention and are not meant to limit the scope of the invention. Various modifications and combinations of the illustrative embodiments, as well as other

embodiments of the invention, will be apparent to persons skilled in the art upon reference to the description.

WHAT IS CLAIMED IS:

1) A writing implement comprising an implement body; and a grip on the implement body; wherein the grip includes a low durometer, thermoplastic elastomer layer, and a flexible outer layer which is resistant to oil absorption.

2) The writing implement of claim 1 wherein the flexible outer layer is a higher durometer thermoplastic layer.

3) The writing implement of claim 1 wherein the low durometer, thermoplastic elastomer layer has a durometer of no more than about 20 Shore A.

4) The writing implement of claim 3 wherein the low durometer, thermoplastic elastomer layer has a durometer of about 25 to 50 Shore 00.

5) The writing implement of claim 1 wherein the low durometer, thermoplastic elastomer layer has a gel-like consistency.

6) The writing implement of claim 1 wherein the low durometer, thermoplastic elastomer layer is at least about 1 mm thick.

7) The writing implement of claim 6 wherein the low durometer, thermoplastic elastomer layer has a thickness of no more than about 4 mm.

8) The writing implement of claim 1 wherein the low durometer, thermoplastic elastomer layer is formed from a thermoplastic elastomer selected from the group consisting of styrenic thermoplastic elastomers, ethylene/propylene/diene terpolymers; elastomeric alloys; and thermoplastic polyurethanes.

9) The writing implement of claim 8 wherein the low durometer, thermoplastic elastomer layer is formed from a styrene-polyolefin block copolymer.

10) The writing implement of claim 1 wherein the flexible outer layer has a durometer of at least about 20 Shore A.

11) The writing implement of claim 10 wherein the flexible outer layer has a durometer of no more than about 100 Shore A.

12) The writing implement of claim 1 wherein the flexible outer layer is a polypropylene layer.

13) The writing implement of claim 1 wherein the flexible outer layer is resistant to sebum oil absorption.

14) The writing implement of claim 1 wherein the flexible outer layer is about 0.1 to 1.0 mm thick.

15) The writing implement of claim 1 wherein the flexible outer layer is formed from a thermoplastic elastomer having a durometer of about 50 to 75 Shore A.

16) The writing implement of claim 1 wherein the flexible outer layer is formed from a thermoplastic elastomer selected from the group consisting of elastomeric chlorosulfonated polyethylenes, thermoplastic polyurethanes, thermoplastic polyolefins, styrenic thermoplastic elastomers, nitrile rubbers, elastomeric alloys, polychloroprene rubbers, polypropylene, elastomeric copolyesters and thermoplastic rubbers.

17) The writing implement of claim 1 wherein the flexible outer layer is formed from an elastomeric alloy, a nitrile rubber, a polychloroprene rubber, a thermoplastic polyurethane, a styrenic thermoplastic elastomer, a PVC/NBR thermoplastic elastomer or a chlorosulfonated polyethylene.

18) A layered material suitable for forming a grip surface on a manual implement, the layered material comprising:

a low durometer, thermoplastic elastomer layer; and

a first flexible higher durometer layer;

wherein the first flexible higher durometer layer is resistant to oil absorption.

19) The layered material of claim 18 further comprising a second flexible higher durometer layer; wherein the low durometer, thermoplastic elastomer layer is sandwiched between the first and second flexible higher durometer layers.

20) The layered material of claim 18 wherein the low durometer, thermoplastic elastomer layer has a durometer of no more than about 10 Shore A; and the first flexible higher durometer layer has a durometer of at least about 35 Shore A.

21) The layered material of claim 18 in the form of a tube.

22) The layered material of claim 18 in the form of a strip.

23) A writing implement comprising an implement body and a grip on the implement body;

wherein the grip includes a low durometer, thermoplastic elastomer layer which has a durometer of no more than about 5 Shore A; and

an outer thermoplastic elastomer layer which is resistant to oil absorption and has a durometer of at least about 50 Shore A.

24) The writing implement of claim 23 wherein the low durometer, thermoplastic elastomer layer is formed from a styrene-ethylene/butylene-styrene elastomer.

25) A method of forming a grip on a writing instrument comprising wrapping a strip of multilayer grip material around a portion of a manual implement to form a grip surface; wherein the multilayer grip material comprises a low durometer, thermoplastic elastomer layer; and a flexible layer which is resistant to oil absorption.

26) A method of producing a multilayer grip material suitable for forming a grip surface on a manual implement comprising coextruding at least first and second layers of thermoplastic elastomer material to form a multilayer construction;

wherein the first layer is a low durometer, thermoplastic elastomer layer; and the second layer is a flexible thermoplastic elastomer layer which is resistant to oil absorption.

27) The method of claim 26 comprising coextruding first, second and third layers of thermoplastic elastomer material such that the first thermoplastic elastomer layer is sandwiched between the second and third thermoplastic elastomer layers; wherein the third thermoplastic elastomer layer is a flexible thermoplastic elastomer layer having a durometer of at least about 35 Shore A.

28) The method of claim 26 wherein the multilayer grip material is in the form of a strip.

29) The method of claim 26 wherein the multilayer grip material is in the form of a tube.

30) A method of forming a grip surface on a manual implement comprising sequentially molding at least two layers of thermoplastic materials onto a grip base of a manual implement;

wherein the at least two layers comprise an outer layer formed from a flexible thermoplastic material which is resistant to oil absorption; and an inner layer formed from a low durometer, thermoplastic elastomer.

31) A method of forming a grip surface on a manual implement comprising:

positioning a sleeve over a grip body to form a cavity therebetween, wherein the sleeve is formed from flexible thermoplastic material which is resistant to oil absorption;

injecting a molten form of a low durometer, thermoplastic elastomer into the cavity; and

cooling the molten low durometer, thermoplastic elastomer to a temperature of no more than about 40°C.

32) A manual implement comprising an implement body and a grip on the implement body capable of being manually grasped during use of said implement;

wherein the grip includes a thermoplastic elastomer layer having a durometer of no more than about 20 Shore A; and

an outer thermoplastic elastomer layer which is resistant to oil absorption and has a durometer of at least about 35 Shore A.

FIG. 1

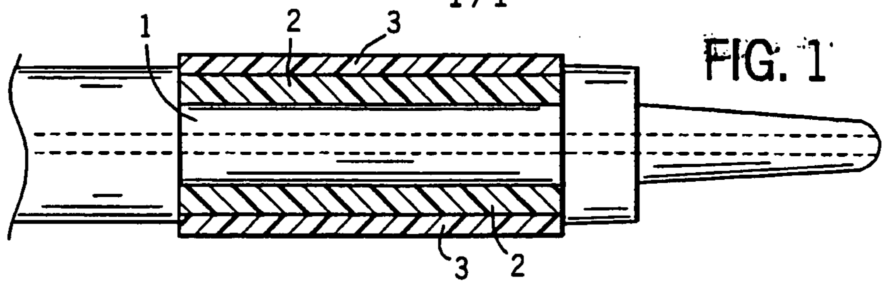


FIG. 2

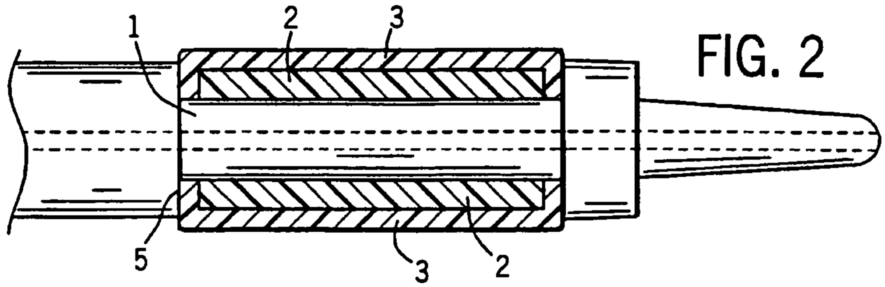


FIG. 4

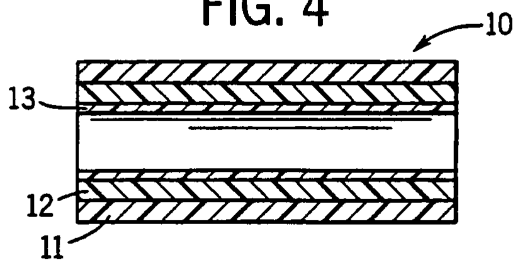


FIG. 3

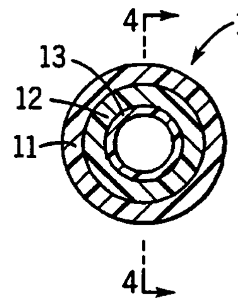


FIG. 5

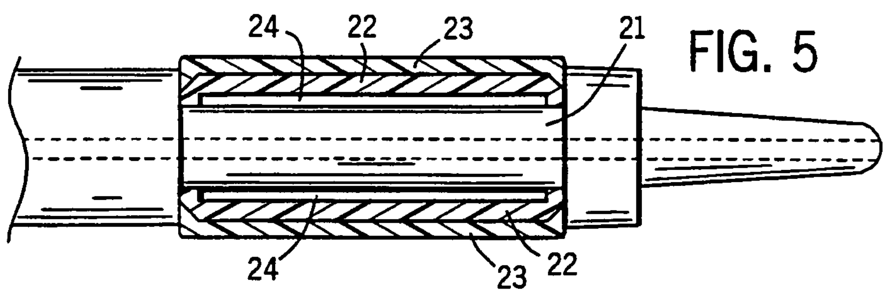
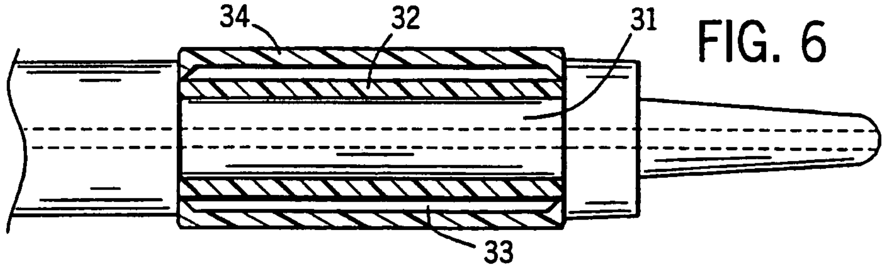


FIG. 6



INTERNATIONAL SEARCH REPORT

Inte .ional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B43K23/008

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B43K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 5 000 599 A (MCCALL ET AL.) 19 March 1991 (1991-03-19) the whole document ---	1,18,23, 25,26, 30-32
Y	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 03, 31 March 1997 (1997-03-31) & JP 08 310179 A (KOTOBUKI:KK), 26 November 1996 (1996-11-26) abstract ---	1,18,23, 25,26, 30-32
A	US 5 348 296 A (FREDERIKSEN) 20 September 1994 (1994-09-20) the whole document ---	1,18,23, 25,26, 30-32
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
23 February 2001	02/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Perney, Y

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	WO 93 15917 A (THE GILLETTE COMPANY) 19 August 1993 (1993-08-19) the whole document -----	1,18,23, 25,26, 30-32

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

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